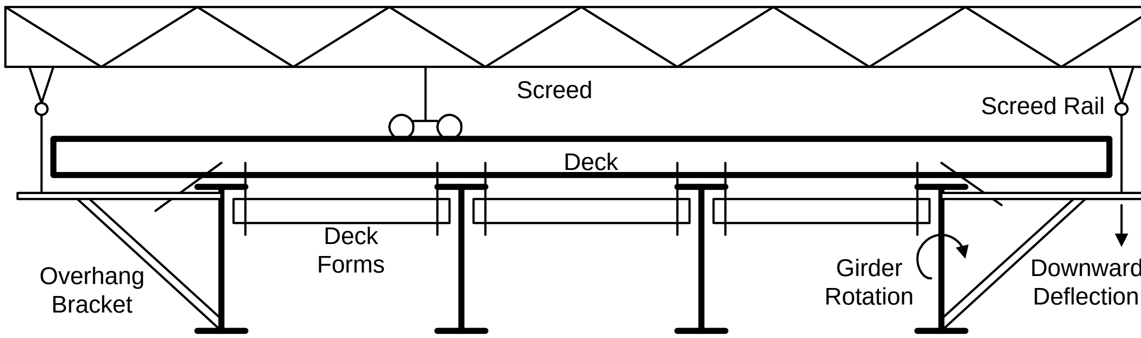
6.10.3.4 DECK PLACEMENT

LATERAL GIRDER ROTATION

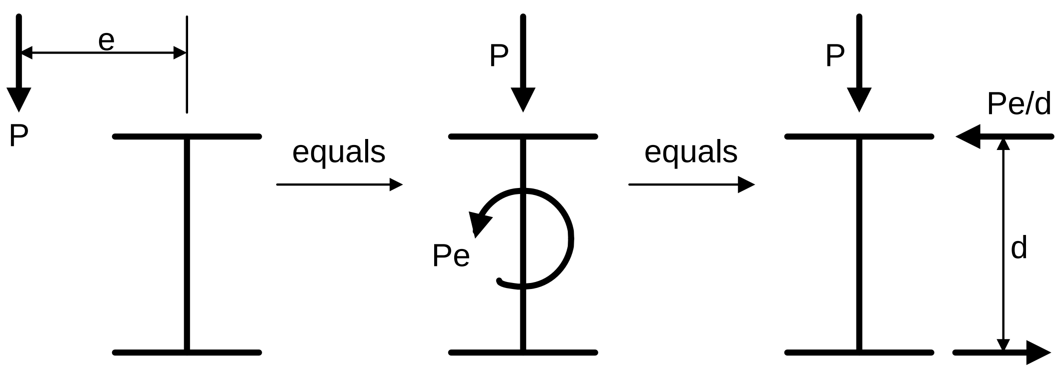
The construction of deck overhangs on steel girders is most often accomplished with the use of standard overhang brackets. The use of these brackets introduces a torsional load into the exterior girders during placement of the concrete deck and the potential exists for the girder to rotate, resulting in excessive overhang deflections. This can adversely affect finished grades when the screed rail is placed at the end of the overhang, the resulting deflection causes the screed to finish the deck lower than anticipated. In order to minimize this problem all steel girder bridges should be checked for rotational deflection.



The magnitude of the deflection at the edge of the deck in relation to the exterior girder is dependent on several factors; rotational stiffness of the girder, diaphragm spacing, amount of deck overhang and screed weight and location.

The calculation of actual rotational stiffness of a welded I-girder is complex, and is made more difficult by the use of diaphragms, the change in flange sizes and the use of unsymmetrical sections. However the problem can be simplified by assuming that any applied torsion acts as a couple with one component of the couple applied to the top flange and the other opposing component applied to the bottom flange. The flanges can then be assumed to carry their respective loads as independent beams in the lateral direction (neglecting the effect of the web). The sum of the two resulting deflections divided by the depth of the girder is the amount of rotation at any given location. This method is conservative and results in rotations approximately 10% greater than would be calculated from a more precise torsional stiffness analysis.

The flanges can be assumed to be continuous beams along the length of the structure with the diaphragms acting as supports. As a result the diaphragm spacing becomes the effective span when calculating the lateral deflections in each flange. The diaphragms should also be checked to be sure they are structurally adequate to carry the resulting reactions.



The couple that is applied to the flanges can be calculated from the net eccentric vertical loading applied to the exterior girders. A typical construction detail involves an overhang bracket on the exterior side of the girder and a beam hanger on the interior side. The loads from this arrangement are multiplied by their respective moment arms as measured from the centerline of the girder and algebraically added together resulting in the applied torsional moment. This moment is then divided by the girder depth and the resulting load applied to both the top and bottom flange to form a couple.

The flanges are then checked for the greatest deflection case and the resulting deflections for the top and bottom flange are added together and divided by the girder depth, which will give the rotation in radians. This value is then multiplied by the overhang dimension giving the amount of deflection that will occur at the end of the overhang. The deflection at the overhang should not be greater than 0.20 inches.

Revision:

April 2008	Renumbered article from 6.10.3 to 6.10.3.4 and changed title to Deck Placement.